CLAIMS

What is claimed is:

1. A method for producing an engineered intervertebral disc tissue, comprising:

(a) culturing intervertebral disc cells in a medium for an effective amount of time to produce intervertebral disc cells surrounded by a cell-associated matrix; and

(b) culturing the intervertebral disc cells surrounded by the cell-associated on a semipermeable membrane in the presence of one or more growth factors for a sufficient amount of time to produce a coherent, engineered intervertebral disc tissue.

2. The method of claim 1 further comprising one or more of:

(c) isolating the intervertebral disc cells prior to (a);

(d) recovering the intervertebral disc cells surrounded by the cell-associated matrix prior to (b);

(e) removing the engineered intervertebral disc tissue from the semipermeable membrane; or

(f) implanting the engineered intervertebral disc tissue into an *in vivo* intervertebral disc defect wherein the intervertebral disc tissue is implanted in the presence or absence of the semipermeable membrane.

3. The method of claim 1 wherein the intervertebral disc cells are nucleus pulposus or annulus fibrosus cells whereby an engineered nucleus pulposus tissue or engineered annulus fibrosus tissue is produced.

4. The method of claim 1 wherein the medium of (a) is an alginate medium.

5. The method of claim 1 wherein the one or more growth factors is selected from the group consisting of osteogenic protein-1, bone morphogenetic proteins, cartilage-derived morphogenetic protein, platelet-derived growth factor, bone morphogenic protein-2, fibroblast growth factor, transforming growth factor beta, insulin-like growth factor and combinations thereof.

6. An engineered intervertebral disc tissue produced according to the method of claim 1.

7. The engineered intervertebral disc tissue of claim 6 wherein the tissue comprises collagen, hyaluronan, proteoglycan and water.

8. The engineered intervertebral disc tissue of claim 7 wherein a majority of the collagen comprises type I or type II.

9. A cohesive engineered intervertebral disc tissue comprised of greater than or about 80 percent water by weight, between at or about 0.95 and 7.5 μg/mg DNA, between at or about 100 and 350 μg/mg proteoglycan, and between at or about 75 and 450 μg/mg collagen, wherein the DNA, proteoglycan and collagen amounts are based on the dry weight of the engineered tissue.

10. The engineered intervertebral disc tissue of claim 9 further comprising between at or about 1.5 and 3.0 μg/mg hyaluronan based on the dry weight of the engineered intervertebral disc tissue.

11. The engineered intervertebral disc tissue of claim 9 wherein the DNA content of the tissue is between at or about 3 and 4.3 μg/mg, the proteoglycan content of the tissue is between at or about 100 and 200 μg/mg, the collagen content of the tissue is between at or about 75 and 175 μg/mg and further wherein a majority of the collagen is type II collagen.

12. The engineered intervertebral disc tissue of claim 9 wherein the DNA content of the tissue is between at or about 0.95 and 1.15 μg/mg, the proteoglycan content of the tissue is between at or about 275 and 350 μg/mg, the collagen content of the tissue is between at or about 350 and 450 μg/mg and further wherein a majority of the collagen is type II collagen.

13. The engineered intervertebral disc tissue of claim 9 wherein the DNA content of the tissue is between at or about 3.3 and 5.5 μg/mg, the proteoglycan content of the tissue is between at or about 100 and 185 μg/mg, the collagen content of the tissue is between at or about 125 and 250 μg/mg and further wherein a majority of the collagen is type I collagen.

14. A method for surgically repairing intervertebral disc damage, comprising:

(a) producing a transplantable intervertebral disc tissue *in vitro*; and

(b) implanting the intervertebral disc tissue into an intervertebral disc defect.

15. The method of claim 14 wherein (a) comprises:

(i) culturing intervertebral disc cells in a medium for an effective amount of time to produce intervertebral disc cells surrounded by a cell-associated matrix; and

(ii) culturing the intervertebral disc cells surrounded by the cell-associated on a semipermeable membrane in the presence of one or more growth factors for a sufficient amount of time to produce a coherent, engineered intervertebral disc tissue.

16. The method of claim 15 wherein (a) further comprises one or more of:

(iii) isolating the intervertebral disc cells prior to (i);

(iv) recovering the intervertebral disc cells surrounded by the cell-associated matrix prior to (ii); and

(v) removing the engineered intervertebral disc tissue from the semipermeable membrane.

17. The method of claim 15 wherein the intervertebral disc cells are annulus fibrosus cells and an annulus fibrosus tissue is produced or the intervertebral disc cells are nucleus pulposus tissue and a nucleus pulposus tissue is produced.

18. The method of claim 15 wherein the medium of (i) is an alginate medium.

19. The method of claim 15 wherein the one or more growth factors is selected from the group consisting of osteogenic protein-1, bone morphogenetic proteins, cartilage-derived morphogenetic protein, platelet-derived growth factor, bone morphogenic protein-2, fibroblast growth factor, transforming growth factor beta, insulin-like growth factor and combinations thereof.

20. A kit for producing an intervertebral disc tissue comprising:

(a) instructions for producing an intervertebral disc tissue; and one or more:

(b) growth media;

(c) semipermeable membranes;

(d) growth factors;

(e) one or more pieces of disposable lab equipment.